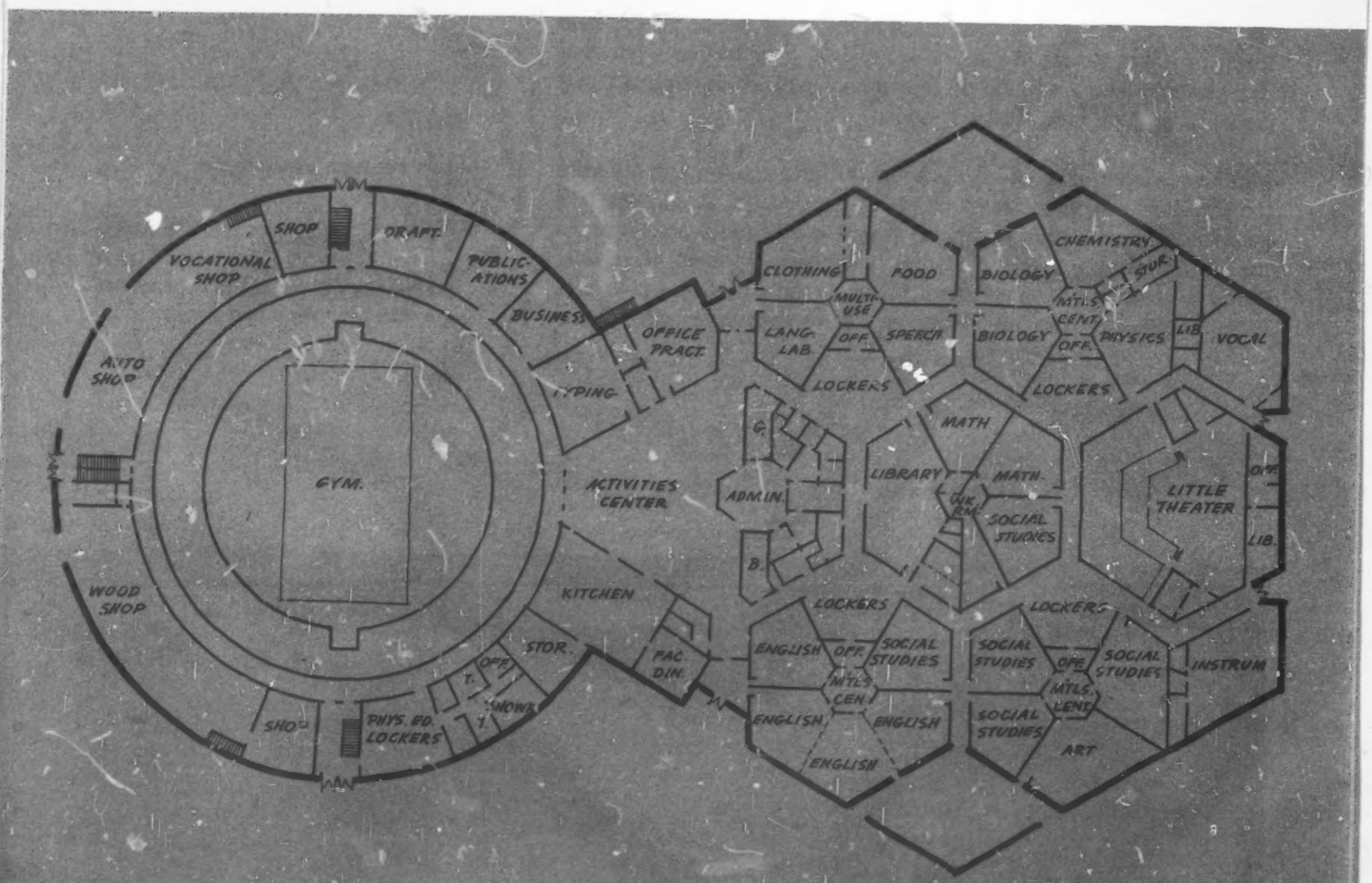
of handling the school's eventual enrollment of 1,500.

McPherson's hexagonal academic cluster is actually a large hexagon filled with smaller hexagons, or, as one entomologically minded educator put it when looking at the plans, "I see they've gone back to the bees." And a honeycomb is very much what the academic cluster looks like. There is hardly a wasted, right-angled corner to be found. Corridors take up about half the space they would in a conventional school (11 per cent compared to about 20 per cent). As in the honeycomb, almost every inch of space is put to productive use.

Each of the interior hexagons in this building is either a cluster of classrooms surrounding a central instructional materials center or in the case of the little theater and the administrative suite, a special arrangement of space for a special purpose. Each of the classroom clusters forms the natural habitat of a teaching team organized around the subject area to which the cluster and its resource center are devoted. And each cluster provides office space for its team.

The space at McPherson High School is divided into two sections, one housing the noisier activities, the other housing the quieter academic work.



The part of McPherson pictured here is actually only the nucleus of the eventual school. The present scheme, therefore, does not fairly represent the ultimate design.

—LARGE, SMALL, AND INDEPENDENT

Now, for instance, there is a dearth of space uniquely fashioned for large and small groups and independent study. Several of the clusters, the English hexagon, for example, will be equipped with operable walls. When the walls are opened, the resulting space will be used for large groups. Lectures can also be accommodated in the 255-seat little theater and the 150-seat rehearsal room. Small group classes and independent study can be carried on in the resource centers. (There are two special small group rooms off the library.)

Eventually the school will have a non-rectilinear, divisible auditorium and music building connected to the academic building next to the little theater, thus filling the need for more large group space. Hexagonal clusters will be added to the academic building as more space is needed by the school's expanding enrollment.

With these additions, the function of the existing hexagons will be changed. The library cluster, for instance, will become one large, central resource and independent study center. Social studies will receive its own cluster instead of occupying space in two other subject clusters. The space inside this school will be redesigned and reshaped as each new cluster is added.

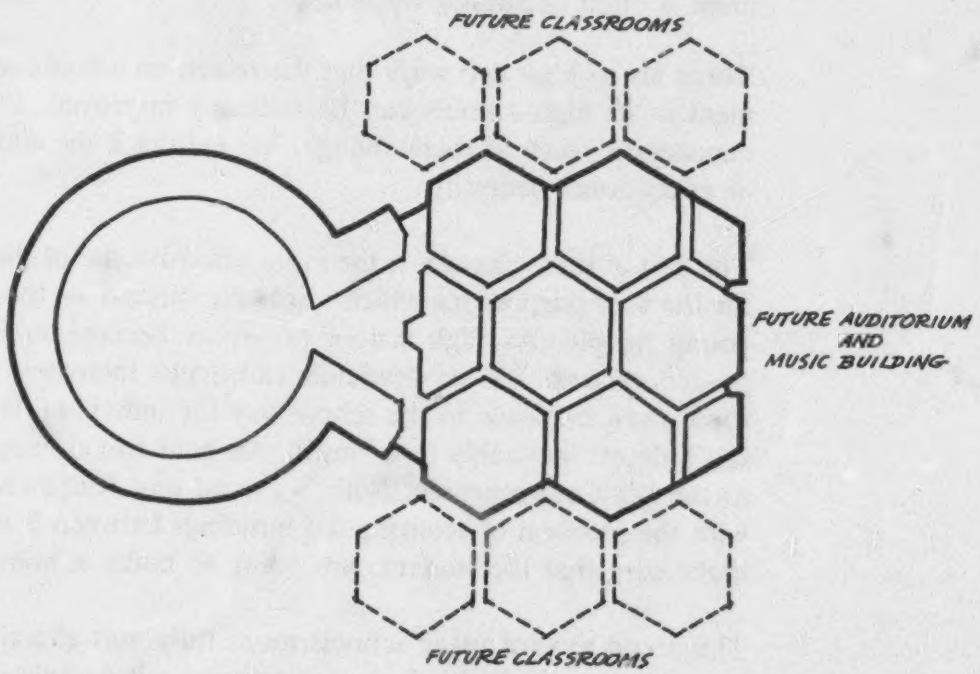
McPherson is an unusual high school. It marks a distinct break with the traditional arrangement and use of high school space. But it is even more unusual than it appears from the schematic drawings. As the plans show, the school is extremely compact. Many of the spaces inside the building have no direct access to the out-of-doors. What's more, McPherson has few windows. These departures were made

—TWO FURTHER DEPARTURES

McPherson will attempt to entrance the eye with its unusual roof design.

possible because the school is air-conditioned. And a compact, almost windowless school creates a singular problem: It is not likely to be a thing of great visual beauty, sitting, as it will on the flat plains of Kansas. But McPherson will be neither ugly nor dull.

The circular section will be covered by the modest curve of a dome framed in steel and decked with a stressed-skin covering. The hexagonal academic cluster will be roofed with softly undulating thin-shell concrete. This unique roof is made up of a series of conoidal barrel vaults which taper in from the edges of the building to meet in the center. These two unusual architectural creations will, it is hoped, successfully bear the building's aesthetic burdens. No viewer, captivated by the contours of the roofs, will mistake it for a warehouse.



McPherson will grow like a honeycomb by the addition of hexagons and an auditorium and music building.

6. THE 4,000-HOUR SCHOOL

The typical American high school — even a stripped-down model— may still be the most expensive building in town. A high school always represents a major investment of time, effort, and money.

Yet too many high schools open at 8:30 a.m. and are clapped tightly shut by 4 or 5 in the afternoon. Perhaps they open up again two or three nights a week for a P.T.A. meeting or a local theater group or a gathering of the local civic improvement committee. Perhaps there is a small, part-time summer session designed to encourage the slower students to catch up. On most evenings of the week, on Saturdays, and during most of the summer months, however, these expensive buildings tend to sit idle. Since use is the major return a schoolhouse can supply to its community, an idle schoolhouse is providing no return for its owners. An all-too-large part of the community's investment is often needlessly wasted.

THE WELL-USED HIGH SCHOOL–

There are at least two ways that the return on a community's investment in its high schools can be radically improved. By happy circumstances, each of these changes has behind it the additional force of educational necessity.

The first of these changes is the more extensive use of the high school for the very purpose for which it was established — the education of young people. As high school programs become increasingly ungraded, as emphasis on academic excellence increases, and as more room must be made in the school day for individual study, the day itself almost inevitably gets longer. An hour has already been added to the Wayland schedule. Both Wayland and Ridgewood are faced with the problem of scouring the buildings between 5 and 6 p.m. to make sure that the students are going to make it home for dinner.

This trend toward using schools more fully and effectively is being spurred in particular by the increased emphasis on independent study. As libraries and resource centers become richer in all of the necessary materials, as students become increasingly engrossed in their complex individual projects, as teachers and students work more and more in conferences, both students and teachers begin to use every available space and minute to carry on their activities. And this would apply well into the evening. The eventual program at Wayland, for instance, is planned so that the building will be open until 10 p.m. for students who feel they need or want to use the facilities.

This same pressure on the schoolhouse to expand its availability no longer tapers off on June 30th. Already many school systems have full-fledged academic programs going throughout the summer on a purely voluntary basis. At one time the rural cycle of seed time and harvest dictated the 180-day school year. There are still vestiges of this cycle, but its dictatorial powers have now been assumed by the demands of the summer vacation. A few school systems have attempted a compulsory 12-month school year, only to be blocked by the annual retreat to seashore and mountain.

But even this is now beginning to give way. At Rich Township High School in Park Forest, Illinois, where a voluntary summer program

is in operation, a student whose parents are away on vacation will often move into a friend's house to stay behind to be able to go to school in the summer. Huck Finn wouldn't understand such behavior, but it happens.

What is becoming more and more apparent is that the conventional school day and school year are no longer sufficient to do the job that needs to be done. The day may shortly arrive when all academically able students may be completing in high school the equivalent of the first year of college. This kind of program requires quite a different concept of how time and space should be used during the high school years. It means, in particular, that any high school in a section of the country where late spring, summer, or early fall are likely to be hot and humid, must begin to think seriously about providing a suitable environment for year-round study.

THE SUBLET SCHOOL–

Assuming for a moment that the burgeoning school program still does not use all of the schoolhouse all of the time, the idea of permanent subletting of space comes into play. In school terms, of course, subletting means designing space with other public uses in mind. Or better still, it means an active attempt to plan and use facilities jointly with other civic agencies — the public library, the recreation or park department, the adult education department. School space often can work admirably for the townspeople to hold meetings or other large public assemblies, committee or club meetings, little-theater groups, lectures, concerts, etc.

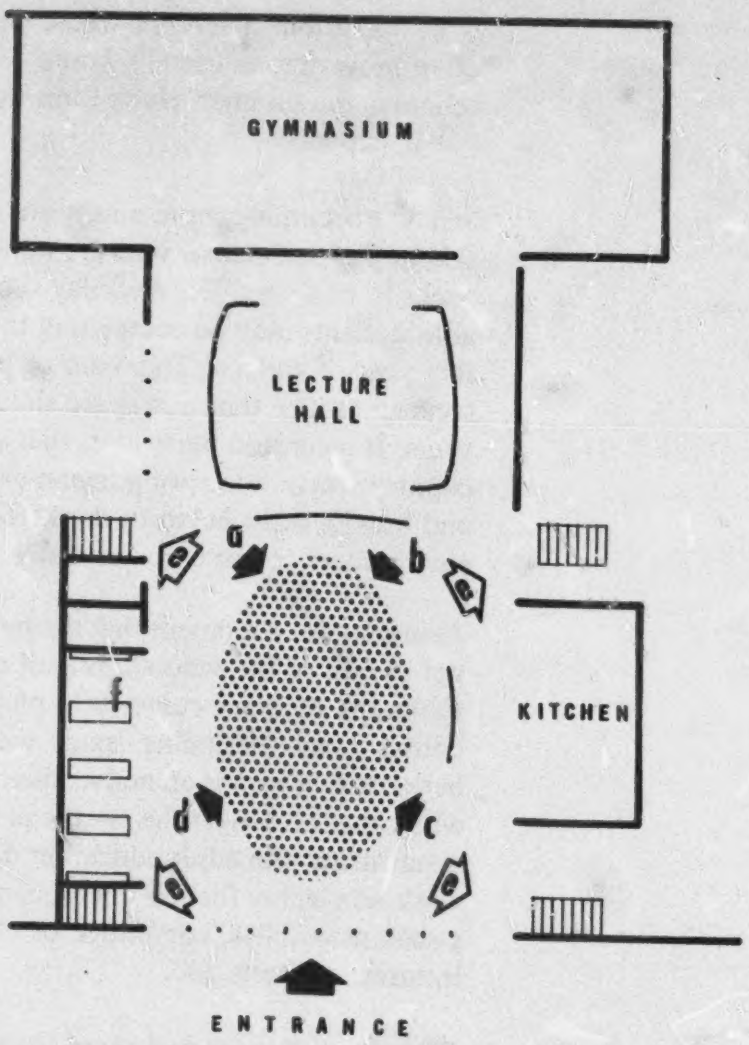
This means a good deal more than simply allowing these other agencies to use school facilities. It means careful cooperative planning before a school is put on the drawing board.

At Wayland, for instance, the domed field house was in part designed to hold 3,000 people at town meetings. There was no other space in town that could handle that large a crowd.

Also at Wayland, the town and the school spent $4,000 to cross-index the school library and the public library. Now when a student goes to the catalogue, he can find out immediately if the book he is looking for exists anywhere in town. If it is not in the school, he can go to the public library and find a copy there. And the citizens of the town are equally free, and are encouraged, to come into the school and use library facilities there. At Ridgewood, the library and reading laboratory will be open to the public as part of an extensive adult education program.

At the new Rich Township High School in Olympia Fields, Illinois, the little theater, cafeteria, gymnasium, and a large central foyer-commons room have been deliberately designed to be used by the public in the evenings for lectures, meetings, theatrical productions, adult physical education, and basketball. The commons, after school, becomes a lobby for the theater and the gym. It is equipped with a snack bar for refreshments.

It happens that Rich Township is one of those suburban communities



a GYMNASIUM LOBBY
b LECTURE HALL LOBBY
c DINING AREA
d DANCING AREA
e TRAFFIC SEPARATION INTO SCHOOL
f COAT STORAGE

The central foyer at the new Rich Township High School can be used for a variety of school and community purposes.

that has few public buildings outside of its schools, and no local facilities for cultural presentations. The high school, of necessity, becomes the center of the community's cultural life.

A similar situation exists in Stillwater, Oklahoma. There the problem was money. The school board didn't have enough of it to build a gymnasium, even though the town is devoted to sports, particularly wrestling. The school people and the civic leaders put their heads together and came up with the idea that the city should build a civic auditorium right next to the high school. Oddly enough, when the auditorium was finished, it had a flat floor, removable seating, wrestling mats, locker rooms, and basketball hoops. But it's there, and both the school and the town use it in happy compatibility.

Perhaps one of the best examples of cooperative planning is now going on in Plainview, Long Island, New York, in connection with the new junior high school. The proposed site for the school is in the middle of town. By 1965 this central location will also include a senior high school and probably the proposed Plainview public library. The town will also locate on this site and in its school building an adult education program and an evening community college program. The auditorium-theater will be used for a theatrical and concert series, the home economics rooms for Girl Scouts and 4-H Club, the industrial arts area for Boy and Explorer Scouts, the

library as a supplementary area for the public library, and art room for adult art classes, the swimming pool and athletic facilities for year-round teen-age and adult recreation programs, and the cafeteria for community functions that require dining facilities.

Plainview will also be instituting a large-scale summer program of remedial, enriched, and advanced academic work. For this reason, as well as for all of the community reasons, Plainview is exploring the possibility of air conditioning.

THE INDEPENDENT INTERIOR –

All schools require heating to some degree, and most contemporary schoolhouses have mechanical ventilation. These two steps bring any schoolhouse two-thirds of the way toward the completely controlled environment, the interior that is independent of the extremes outside it. The final third of the way is the addition of cooling, giving the people inside the school the ability to maintain a comfortable, productive atmosphere no matter what storms are raging outside, no matter how hot and debilitating the summer months may be.

There are now over 200 fully or partially air-conditioned schools in the United States, and the number is growing rapidly. ("Air conditioning" here means the deliberate attempt by mechanical means to control the temperature, humidity, cleanliness, and distribution of the air inside a building.)

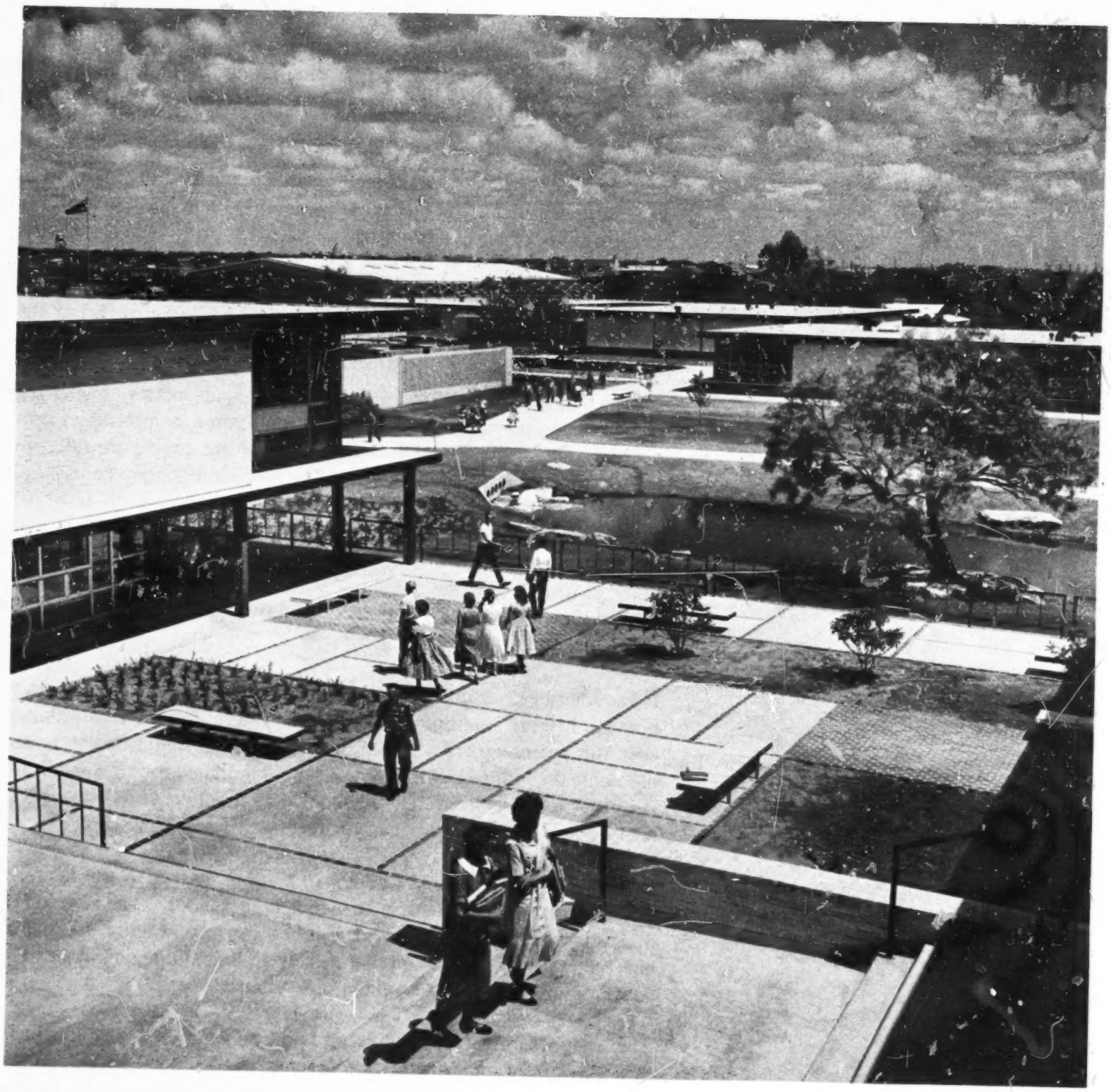
It has long been assumed by the popular mind that air conditioning, because it is an additional benefit, must therefore entail additional cost. But recent experience with the design of air-conditioned schools has come up with a startling fact: a school designed for air conditioning need not cost more than a school with a conventional system of heating and ventilating. It can, in fact, cost less.

THE SECRET OF DESIGN –

It is quite true that simply adding a cooling system to the heating and ventilating system of an existing high school of conventional design is going to cost money. And it is going to cost more to build a new but conventional school that merely adds cooling equipment to a conventional heating and ventilating system.

There *are* examples of schools of fairly conventional layout which through careful and imaginative design have included cooling at no extra cost. San Angelo Central High School in San Angelo, Texas, designed by Caudill, Rowlett and Scott, and opened in 1958, is one.

The architects ran cost estimates on this design and on a similar non-air-conditioned school. The two estimates were almost exactly the same. It turned out that, even with the additional cost of cooling equipment, the elimination of ventilation windows and other details brought the cost down and paid for the equipment. It was found, also, that since sealing up the building kept out dust and dirt, the cost of maintaining the building was substantially reduced. This, according to the school administrators and the architects, has more than made up for the increased cost of operating the cooling equipment. The cost of this school, exclusive of site, furniture, and other movable equipment but including cooling, was $12.50 per square ft.



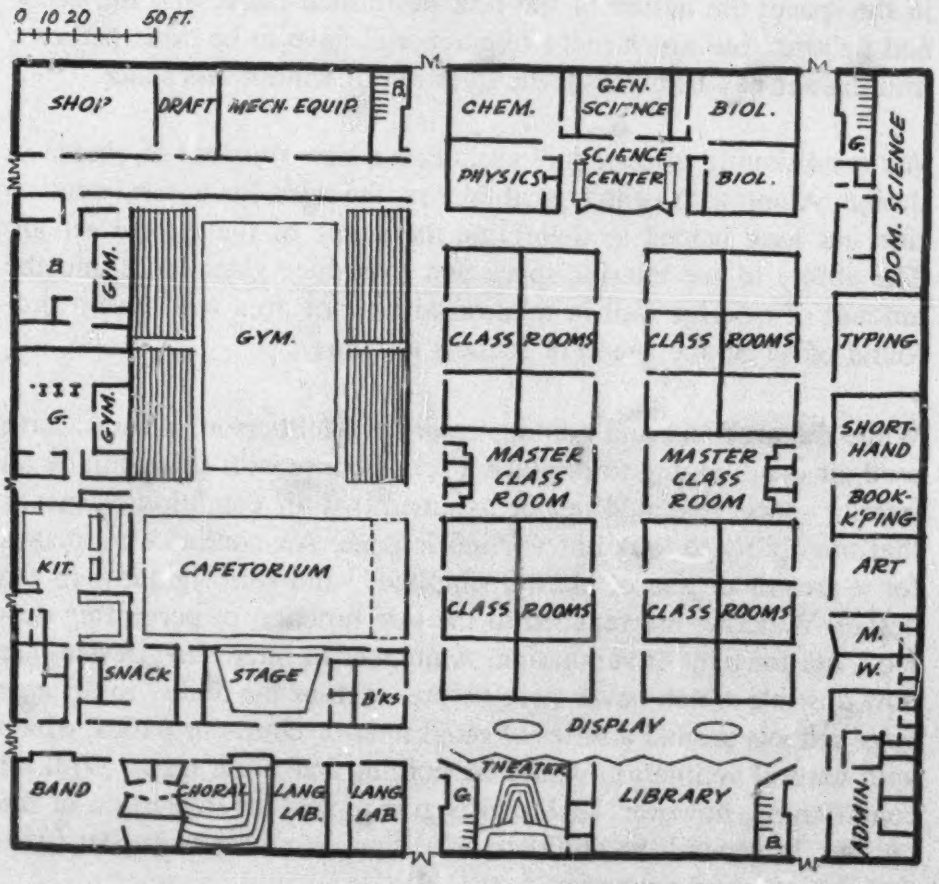
San Angelo High School has air conditioning yet cost no more than a conventionally designed school.

In Pinellas County, Florida, last year, the Board of Public Instruction put two junior high schools out to bid, one a typical Florida school designed for maximum breeze cooling, the other containing the same educational space but designed for mechanical cooling. Pinellas Park Junior High, the conventional design, was bid in at $680,778. Oak Grove Junior High, the air-conditioned school, came in at $664,082.

Another Texas school, now under construction, the South Park High School outside of Beaumont, Texas, is an extremely compact, loft plan design which will be completely air conditioned. South Park will hold 1,200 students.

This school was bid in at $1,198,100, excluding the cost of site, landscaping, furniture, and fees, but including the complete mechanical system, some folding partitions, and terrazzo flooring. This figures out to $11.99 a square foot for 99,906 square feet. Although an equivalent conventional school was not bid at the same time, the architects, Golemon & Rolfe, estimate that this building is about 15 per cent less expensive than typical schools in the area. These schools, the architects say, generally run about $13 per square foot.

The architects also claim that South Park High School will cost substantially less to maintain and operate because of the nature of its design and its air conditioning. They point out, too, that the initial construction savings, when translated into reduced amortization costs over the next 20 years, mean an annual saving that will more than offset any expected rise in operating costs at South Park.



It would be difficult to get a much more compact design than South Park. The interior can be altered by moving partitions to accommodate different programs requiring different arrangements of space.

A BETTER SCHOOL FOR LESS?—

At McPherson High School, a careful cost comparison study was actually made between this unique, year-round school and 22 conventional, uncooled schools bid at approximately the same time in Kansas and in Nebraska, and Oklahoma. The study of these schools, made by the F. W. Dodge Corporation and the three state departments of education, showed that the mean cost of these schools was $13.88 per square foot.

McPherson was bid in at $11.80 per square foot, 15 per cent below the average.[8] The building actually came in about $100,000 below the architects' most conservative estimates.

[8] *See appendix for this study.*

What makes savings such as this possible? It is economies in design brought about by a more compact plant involving less extensive perimeter and less space devoted to circulation. Air conditioning makes it possible to build comfortable academic space that has no direct access to the outdoors.

Do people object to or suffer from going to school in wholly enclosed space that does not offer them the visual relief of looking out of windows? There is no general agreement as yet to the answer to this question. Both sides can be argued with considerable persuasion. The experience with existing schools and commercial buildings having this kind of interior space seems to indicate that people, once they are accustomed to it, do not react adversely. Laboratory scientists seem to prefer enclosed space, but office workers only tolerate it. In some schools the students and teachers even come to like it.[9] Apparently the reaction of occupants to interior space depends on at least four variables: the size of the space; how long the occupant remains in the space; the nature of the task performed there; and the decor and lighting. But much more research will have to be done before a firm answer can be given to the question of windowless space.

[9] *See* EFL's *Profile,* Hillsdale High School.

Air conditioning gives school architects a new freedom of choice in design. Along with pedagogical factors, the need for natural ventilation has long helped to determine the shape of the typical school. The ability to use interior space and to reduce glass areas and the amount of exterior wall in relation to interior area will have a profound effect on the shape of schools to come.

—AIR CONDITIONING AND SCHOOL DESIGN

While the architect and administrators at McPherson, Kansas, have used air conditioning to produce a schoolhouse with substantially all interior space, it should not be assumed that air conditioning means that the ability to look out (or in) is gone. Air conditioning makes for a greater degree of clarity, simplicity, and forthrightness in the design. Windows are reduced to the sole function of permitting outlook, not for light or ventilation. A number of interesting devices are now possible which never were before, such as the ability to arrange large schools around a series of small interior courts or patios, which with natural ventilation would be nothing but noise traps. With air conditioning, however, such courts give a pleasant suggestion of the outside. In general the ability to condition air promises greater function, beauty, and economy.

The town of McPherson decided it could spend no more than $1,430,000 for its new high school building. Whatever the educators and architects wished to do with the school had to be done within that budget.

—THE COST OF ONE CONTROLLED ENVIRONMENT

While the architects, Shaver and Company, were designing the school, they kept a careful estimate of the money they hoped they were saving and the extra money they were spending by their innovations. When the bids came in, the architects compared McPherson's costs with those of another high school built by the same contractor. These were their findings:

ITEM	MCPHERSON Perimeter/1,391 lin ft	USUAL BLDG. Perimeter/3,258 lin ft	SAVINGS	EXTRA
Exterior Masonry Walls	$ 30,326	$ 97,901	$ 67,575	
Foundations, Walls, Footings	$ 55,769	$123,285	$ 67,516	
Pipe Tunnels	$ 3,096	$ 18,105	$ 15,009	
Windows	$ 8,500	$ 38,100	$ 29,600	
Glass, Glazing	$ 11,600	$ 31,760	$ 20,160	
Miscellaneous Savings			$ 2,877	
Heating, Air Conditioning	$179,098	$236,458*	$ 57,360	
Roof and Wall Insulation	$ 19,870	$ 9,687		$10,183
Lighting Fixtures	$ 29,500	$ 22,100		$ 7,400
TOTAL SAVINGS			$260,097	
TOTAL EXTRAS			$ 17,583	$17,583
NET SAVINGS			$242,514	

* *heating only*

Thus, the cost of air conditioning was more than offset by the compact design of the building. In addition to other savings because of the lower perimeter and reduced corridor space and window area, heating and cooling loads for the building were reduced. (The cost of both heating and cooling equipment for McPherson was $57,360 less than the cost of heating equipment alone for the conventional school.)

For a cost of $1,326,986, or $103,014 less than it had expected to spend, the town of McPherson received a complete 800-student air-conditioned school.

By "complete" here, the architects really mean complete. Normally, square-foot-per-pupil cost figures do not include the cost of the site, site preparation, architect's fees, or movable equipment. In this case, the cost of the site itself, the architect's fees, and the cost of tables and chairs were excluded. But the following were included in the $1,326,986: all site work, all of the school's electronic equipment (a complete language lab, tape recorders, stereo hi-fi sets, overhead projectors, the public address system, a scoreboard for the gym, television outlets and conduits), the telephone system, gym lockers and benches, the fire alarm system, and even a bronze dedication tablet. All this for $11.80 a square foot.

Movable equipment for the classrooms and cafeteria came to $21,800. Operable walls cost $12,000. Telescopic bleachers for 3,400 people came to $35,000. The 47-acre site cost $20,000. These extra items total $88,000 or $14,214 less than the limit of $1,430,000 for which McPherson expected to get a relatively unequipped building.

7. AN ENVIRONMENT OF RESPECT

The trend toward greater amenity in building in America is unmistakable. While schools have lagged behind office buildings, homes, department stores, and barber shops in this respect they, too, are beginning to provide a higher degree of amenity.

This current trend toward a higher quality of environment in the schoolhouse is based on a firm belief that an environment that shows a respect for and pleases the students and the teachers is an environment in which they will work more effectively. This belief is reasonable but cannot at this time be certified by scientific evidence.

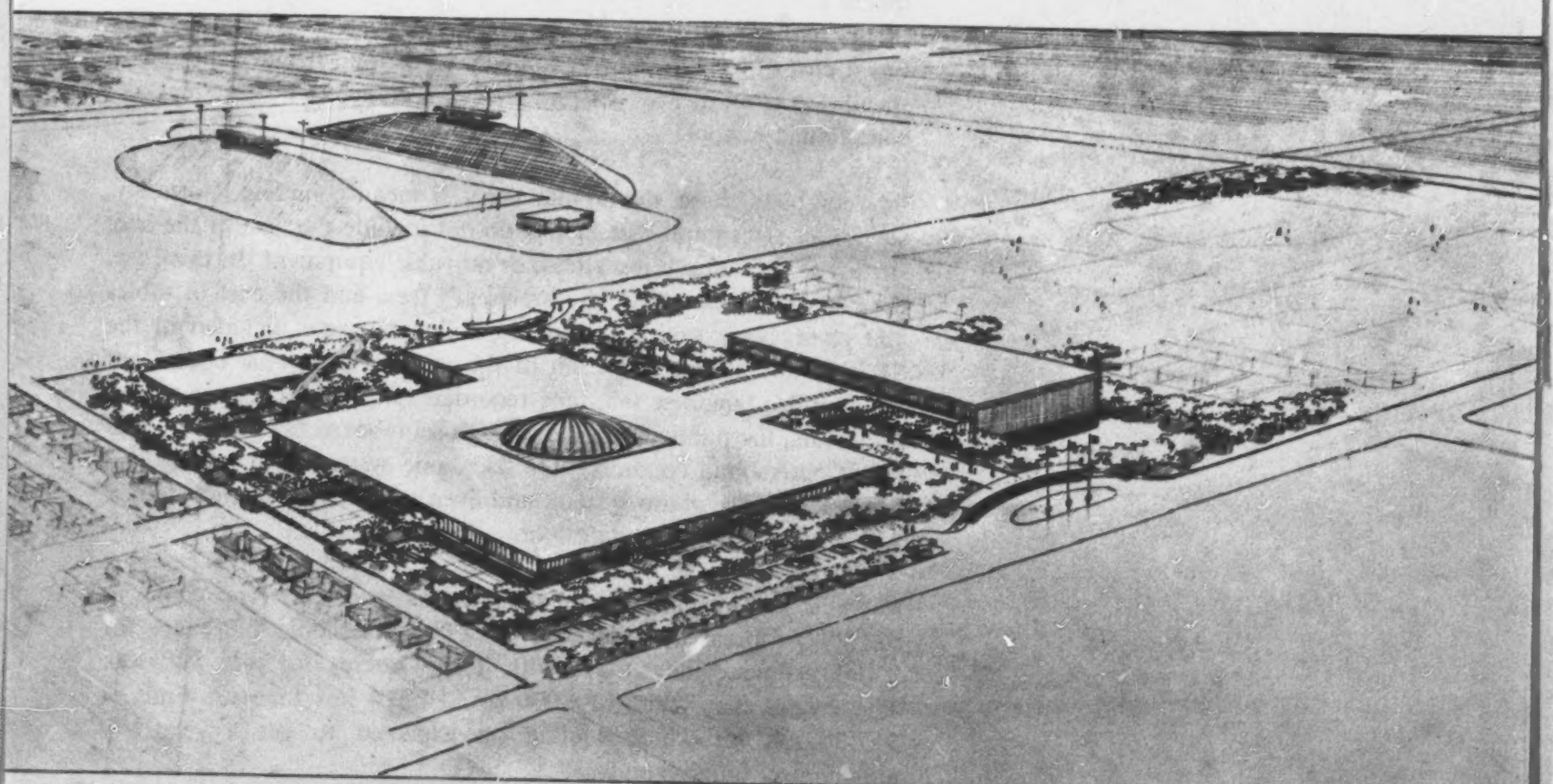
The community that respects itself and its children and seeks a high quality of instruction should create a schoolhouse that will attract students and citizens, a place that will compete with the corner drugstore and bowling alley for the student's time and energy. The local high school should be at least as productive, as aesthetically pleasing, as comfortable a human enclosure as the department store or the office building down the street.[10]

A new high school now being built in Andrews, Texas, is taking a giant step in this direction. In its potential arrangement of space and its general environment, the Andrews Senior High School employs a large number of the advances in building created by contemporary technology. As a structure it competes in function and dignity with the local bowling alley or the new home of the insurance company. It will be air-conditioned, lighted by a luminous ceiling, and will have academic spaces that will be carpeted, door to door, wall to wall.

[10] *An EFL study exploring the effects of environment on learning is now under way at the University of Michigan.*

SUCH A SCHOOL—

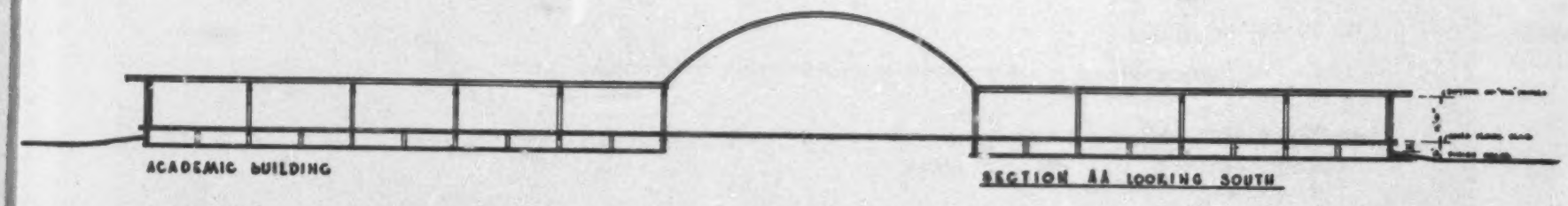
The new Andrews Senior High School will house 800 students when it opens in January, 1962, but can be expanded to accommodate 1,500.

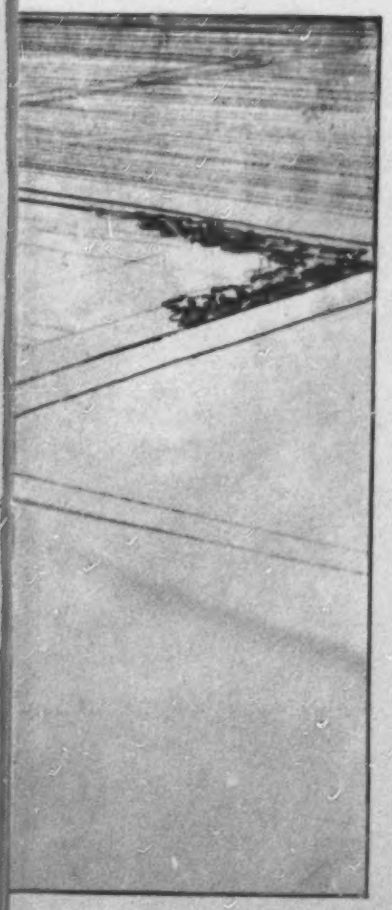


This high school, designed by John Lyon Reid, is basically a loft plan school, similar to Reid's celebrated quartet of loft schools in San Mateo, California.[11]

[11] *Hillsdale, Mills, Crestmoor, and Aragon High Schools. See* EFL's *Profile,* Hillsdale High School.

The fundamental concept behind any loft plan is the creation of a broad, enclosed space interrupted by as few columns or permanent facilities as possible. This is a system widely used in industrial and office buildings, and it has the great virtue in schools of providing space that can easily be adapted to almost any educational program as changes appear desirable. A loft is achieved by designing the structural frame of the building so that the frame — and nothing else — supports the roof. Usually the frame and the interior space are built on the repetition of a modular bay. In this case, each bay is 30 feet by 30 feet and is repeated throughout the design of the school's academic spaces.



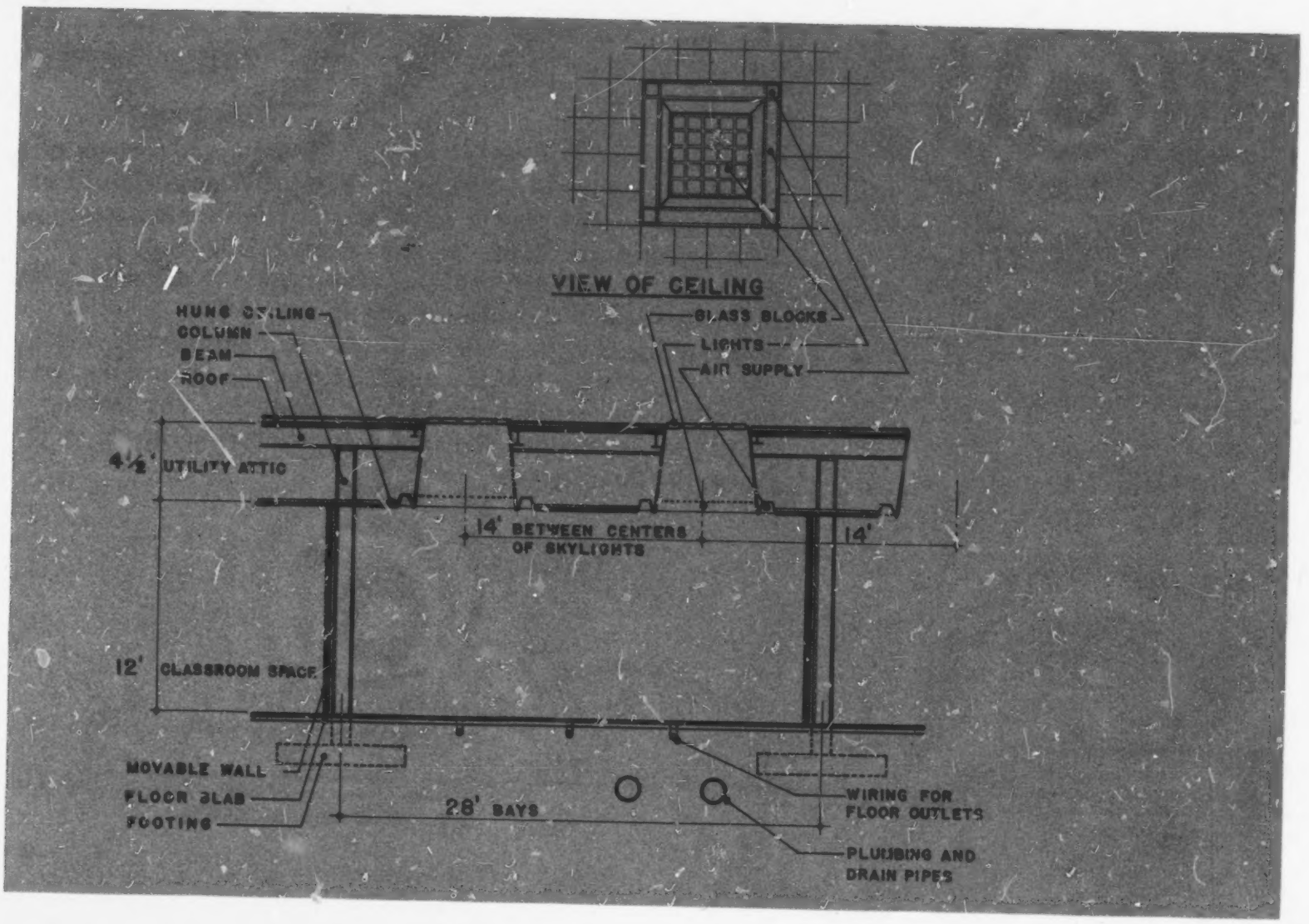


Because the frame rather than the interior walls supports the roof, the space inside the loft can be left free and open — except for the columns at each 30-foot interval. The drawing above shows how the academic space at Andrews will look in cross-section.

The frame of Andrews is unusual, for it is made of prestressed and precast concrete, one of the first high schools in the country to use this relatively new and revolutionary building material. The roof deck is made up completely of prestressed slabs. Most of the beams are precast; the columns are poured in place.

The decision to use precast and prestressed structural components was made because the community of Andrews wished to have a fire-resistive high school (Andrews is the home of many oil wells and thus is quite fire conscious). The use of concrete for framing will effect substantial savings on fire insurance rates. Prestressed concrete also is an economical method of achieving long, clear spans. Reid estimates that this would have been a more expensive building if he had attempted to use a steel frame fireproofed with poured concrete.

Creating a loft frame of repetitive bays still leaves two crucial problems: To make sure that the utilities do not get in the way of the ability to alter the interior space; and to find a system of movable interior partitions that will make such adaptability possible.



A Hillsdale bay in cross-section.
By placing all of the mechanical lines and ducts in the ceiling utility loft, Reid was able, in the San Mateo schools, to clear the interior academic spaces of almost everything but columns.

In the San Mateo schools, Reid solved these two problems by a coordinated system of skylighting, a utility loft in the ceiling which carries most of the ventilating, water, gas, and heating lines and ducts, and a system of movable steel partitions that could be set up at any 4-foot interval.

At Andrews, Reid has made two changes in this structural system. Because of the prestressed concrete roof system, he has been able to increase his column spacing to 30 feet. Instead of using a utility loft, he has created a five-foot utility plenum beneath most of the academic space to contain the gas, water, plumbing, heating, ventilating, and cooling equipment.

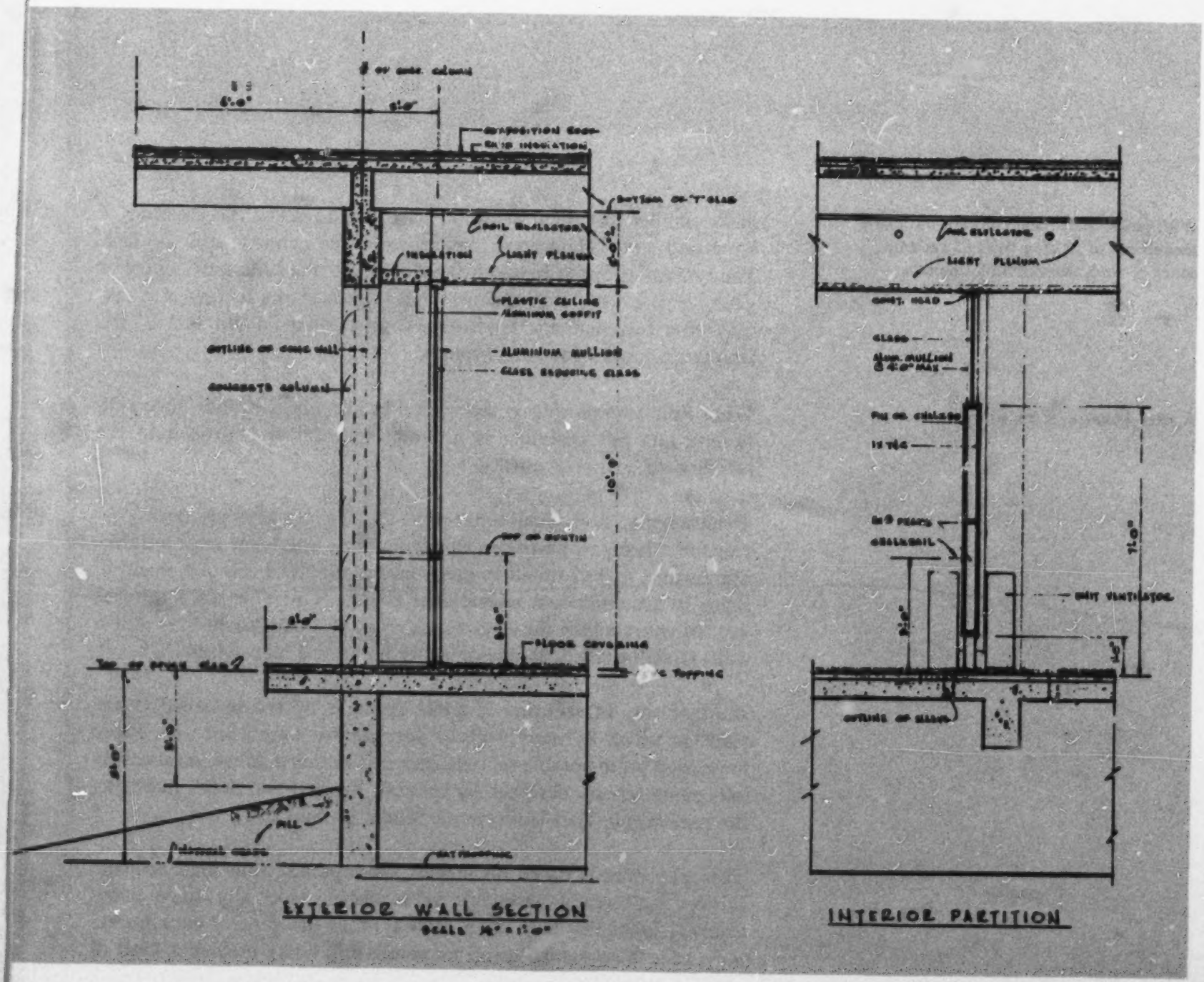
The ducts, through which heated or cooled air is convected, are brought up through the floor slab at every room into an air-conditioning cabinet which will be thermostatically controlled. These cabinets can be easily relocated with any change in partition arrangement. The utilities, too can be tapped from the plenum, and thus are not dependent on any particular arrangement of the partitioning.

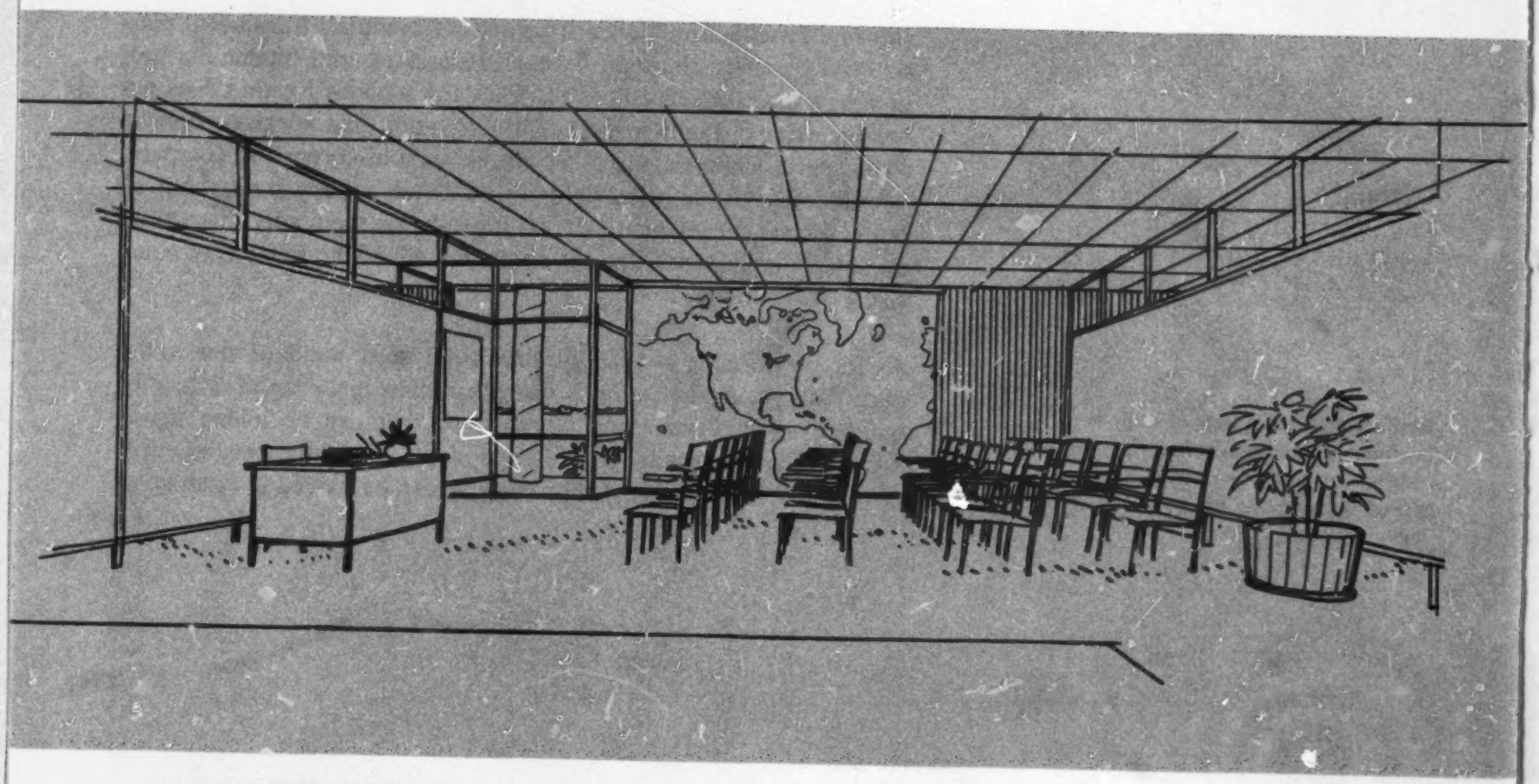
The ceiling is given over to a continuous luminous lighting system throughout most of the academic spaces (including the dome). The luminous ceiling, comparatively common in newer office buildings, is

still rare in school buildings. It consists of modular, translucent plastic ceiling panels, the light fixtures themselves, and, under the roof panels, a layer of reflecting foil. Thus the school's lighting does not have a series of point sources that give more than adequate light in some spaces while leaving other places, such as corners, in comparative darkness. Rather, the light is distributed equally throughout all of the school's academic space, falling alike on the reader, the writer, the diner, the browser, and the chatterer. All of the space is of equal visual productivity.

As for partitioning — at Hillsdale, Reid used standard steel office partitions. At Andrews, he is using a system made up of 3 foot by 6 foot 8 inch hollow-core, wood doors that can be joined tightly together in tongue and groove fashion — but which can be easily demounted. Thus any of these partitions can be moved to open up or

Reid's integrated system of utilities, heating, ventilating, cooling, lighting, and partitioning is displayed in these cross-section framing and mechanical diagrams.





With pipes, ducts, and columns all neatly tucked out of sight, a typical academic space at Andrews will look like this.

make smaller any 30 foot by 30 foot bay, to allow the creation of large and small classrooms, offices, resource centers, and the like. The remaining space between the doors and the luminous ceiling is glass, to give a sense of openness and to reduce any feeling of claustrophobic containment that students or teachers might feel in the largely enclosed windowless spaces.

A NEW APPROACH TO ACOUSTICS –

What Reid is exploring in this school besides the virtue of air conditioning and loft planning is a somewhat radical approach to the problem of school acoustics.

Traditionally, acoustical separation and/or privacy has been provided in schools by partitions which are thick, relatively impenetrable, immovable, and ill-suited to quick and economical rearrangement of space to accommodate educational change. Operable walls are one way of overcoming the drawbacks. But an operable wall is still a wall. Once installed, it cannot easily be moved elsewhere.

Another way of securing mutable space is by the so-called "open plan" in which as many walls as possible are simply left out. There have been some notable schools designed in this manner, most especially some schools designed by Caudill, Rowlett and Scott, including the remarkable Carl Underwood School in Andrews.

The open plan is based on several assumptions: that high acoustic privacy isn't really necessary in a school, especially since many teachers leave the door open anyway; that the general background noise of a busy school (and its ventilating fans) creates a kind of

acoustic privacy for a class intent on its work; that, therefore, it is possible to leave off at least one wall of a classroom without creating an unworkable acoustic situation; and that this kind of openness can make a distinct contribution to a school's ability to adapt to educational changes that may take place.

What Reid is up to at Andrews is a logical extension of the idea of open planning. An eagle-eyed reader may have noticed that in Reid's loft partitioning system there is a six-inch space between the floor and the beginning of the partition. No attempt has been made to have the walls provide a high degree of acoustical separation between the rooms.

How, then, is Reid going to control the sound in this school, especially since the luminous ceiling eliminates the possibility of conventional acoustical tile? Essentially by two methods:

Regulating the level of sound produced by the air-conditioning system so that the system provides a large part of the covering background noise;

Drastically reducing the amount of sound created in the first place by covering the floor with carpet.

AN ACOUSTIC, INSULATIVE FLOOR COVERING –

When Newtonville, New York, opened its new Shaker High School in September, 1958, the incoming students found that half of their building was supplied with conventional asphalt tile flooring. They found the other half was covered, wall to wall, including stairs and corridors with 25,000 square feet of commercial carpeting of the hotel-office variety. This experiment was underwritten by the American Carpet Institute.

For the past three years now, this carpeting has been subjected to strict observation and tests. To date, it has cost $176.61 a year to maintain every 1,000 square feet of carpet. It has cost almost twice as much, $350.75, to maintain every 1,000 square feet of tile. What's more, it took about half the time — 34 compared to 64 minutes a day — to maintain the carpeting. School officials estimate that the carpeting's acoustic qualities have reduced the noise level at Shaker High School by 50 per cent.

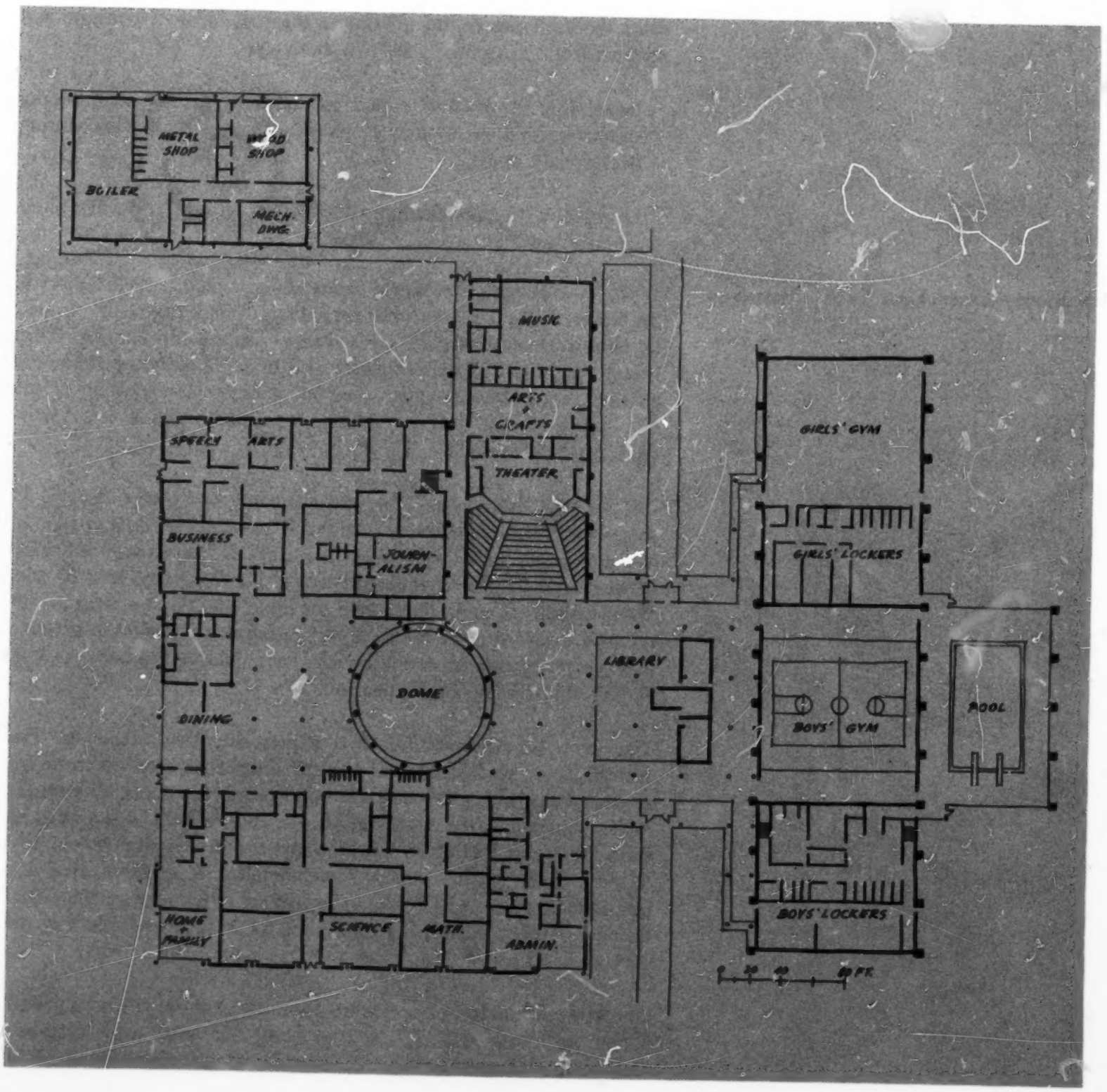
The town of Andrews has had experience with carpeting. The American Carpet Institute has also run a three-year test on carpeting in one of the town's five neighborhood primary schools. The results are as startling as the results at Shaker High School. The carpet in this school cost $2,000 to install. Vinyl tile in a similar school cost $1,120. Based on three years of maintenance, a projected nine-year cost sequence showed that the town will not only make up that $880 initial difference but save an additional $1,207, or about half of the carpet's total initial cost.

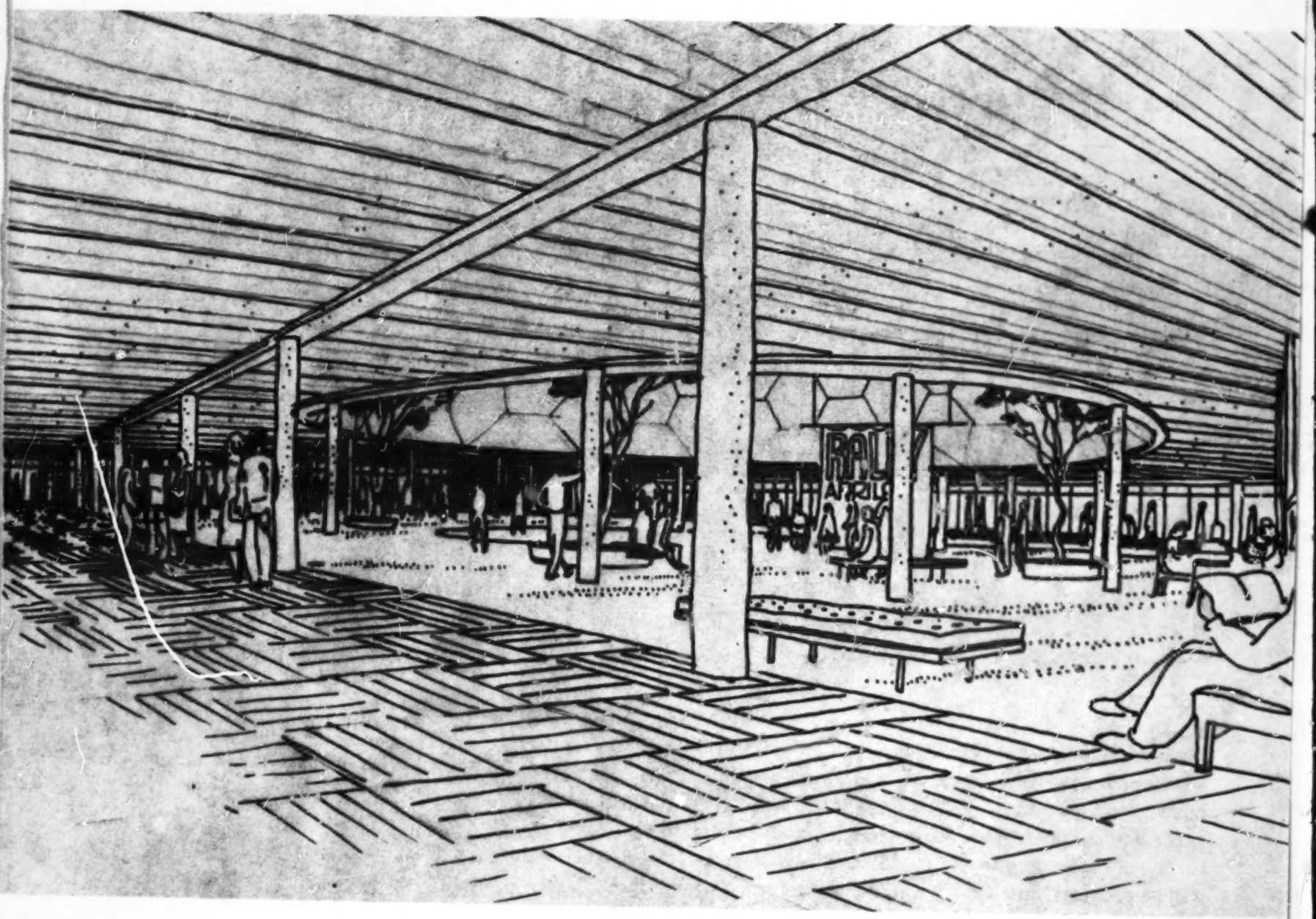
Carpeting, while less expensive to maintain, *is* more costly to install. When Andrews High School was being designed, cost estimates showed that carpeting would have an initial installed cost of $1.11

per square foot as opposed to $.45 per square foot for vinyl asbestos tile. Because of carpeting's ability to stop noise from starting, however, Reid estimates he was able to save one quarter of the cost of acoustical work. He was also freed, by these same acoustical qualities, from the necessity of using the ceiling for acoustical treatment. He was thus able to use the entire ceiling to provide the school with the luminous lighting system.

Taking all of these savings into consideration, Reid is certain that within eight years, the cost differential on the carpeting will have been erased by the savings on maintenance, heating, and cooling. After

Andrews High School is designed around a central concourse area containing the library, a domed interior court, and dining and lounging space.





The area under the dome is floored with terrazzo, not carpet, and will be used for large assemblies, dancing, and even play productions. The concourse area is paved with brick. The dome itself, 82 feet in diameter, is made of precast concrete ribs covered with metal decking except around the bottom rim where there is skylighting.

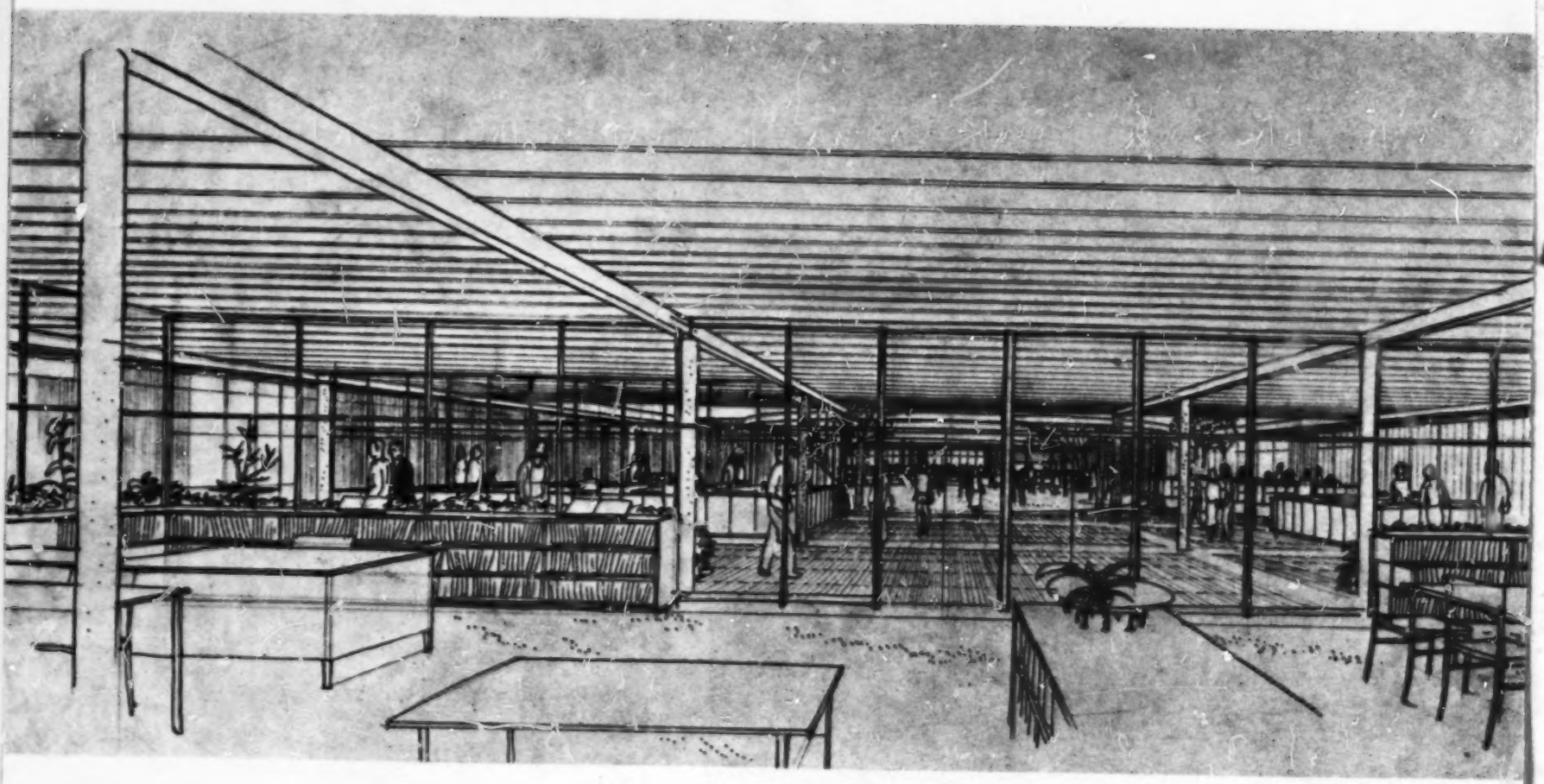
that eight-year period — even if some of the carpeting in the busiest spots will have to be replaced — Andrews will be reaping a real economy from its decision to carpet the school.

But the best reason for carpeting Andrews was not, in Reid's mind, the resulting economy but rather the acoustical, educational, and environmental qualities that carpeting offers a school. As Millard J. Smith, principal of Shaker High School, has said, "The carpeting has set the tone of our school. Students are quieter, better behaved, and more respectful. They feel at home. The result, we think, has been a far better atmosphere throughout the school building."

SPACE TO PROMOTE LEARNING –

What Reid and the educators at Andrews are striving for in this high school is, in the words of T. A. Roach, the superintendent at Andrews, "a school atmosphere and climate for learning which cause children to want to go to school, to participate and share with others in the planning and carrying out of learning experiences."

"The educational program at Andrews," Mr. Roach goes on, "is so



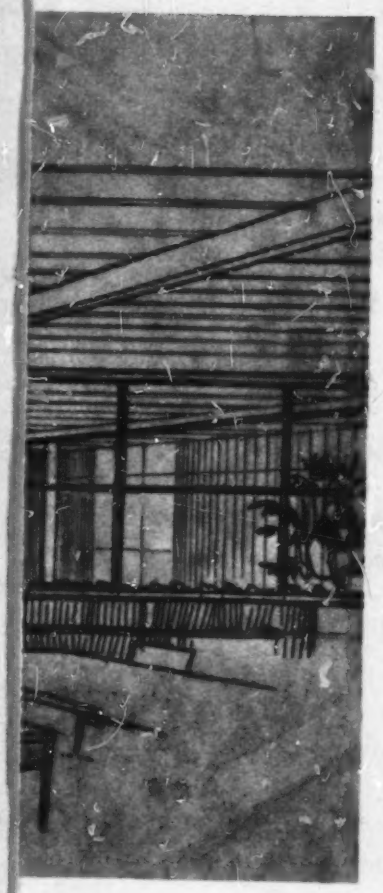
The glass-enclosed library at Andrews looks out on the concourse area toward the dome and the dining area.

planned and the building so designed as to make it possible for us to adapt to any present or new ideas with respect to a secondary educational program. The installation of movable partitions will make it possible for us to adapt teaching and learning to small groups or to very large groups of students. Block time and team teaching will be gradually introduced into the instructional program. Certainly all of the ideas of machine teaching, language laboratories, audio-visual aids, and closed-circuit television will be experimented with, evaluated, and utilized in every way that we find them valuable to our program. Acoustical and environmental controls have been so designed as to make it impossible for a teacher or his students to feel that they are 'an island unto themselves,' but rather a part of a cooperative environment for learning."

—THE COST OF A RESPECTFUL ENVIRONMENT

Andrews — even with its completely controlled environment, its luminous ceiling, and its carpeting — is not an expensive school. This high school cost $2,672,100, or $13.73 per square foot— slightly more than the average of about $13 per square foot for Texas quoted by the architects for Beaumont's South Park High School. This would indicate that the mature environment such as the one at Andrews — given careful, imaginative design — can cost no more to construct than a conventional and considerably less-inviting schoolhouse. (This can be said only for construction cost and does not necessarily apply to operating cost, about which little is known at Andrews.)

Andrews will house only about 800 students when it opens. Reid, however, figures that the space provided in this school will be able to

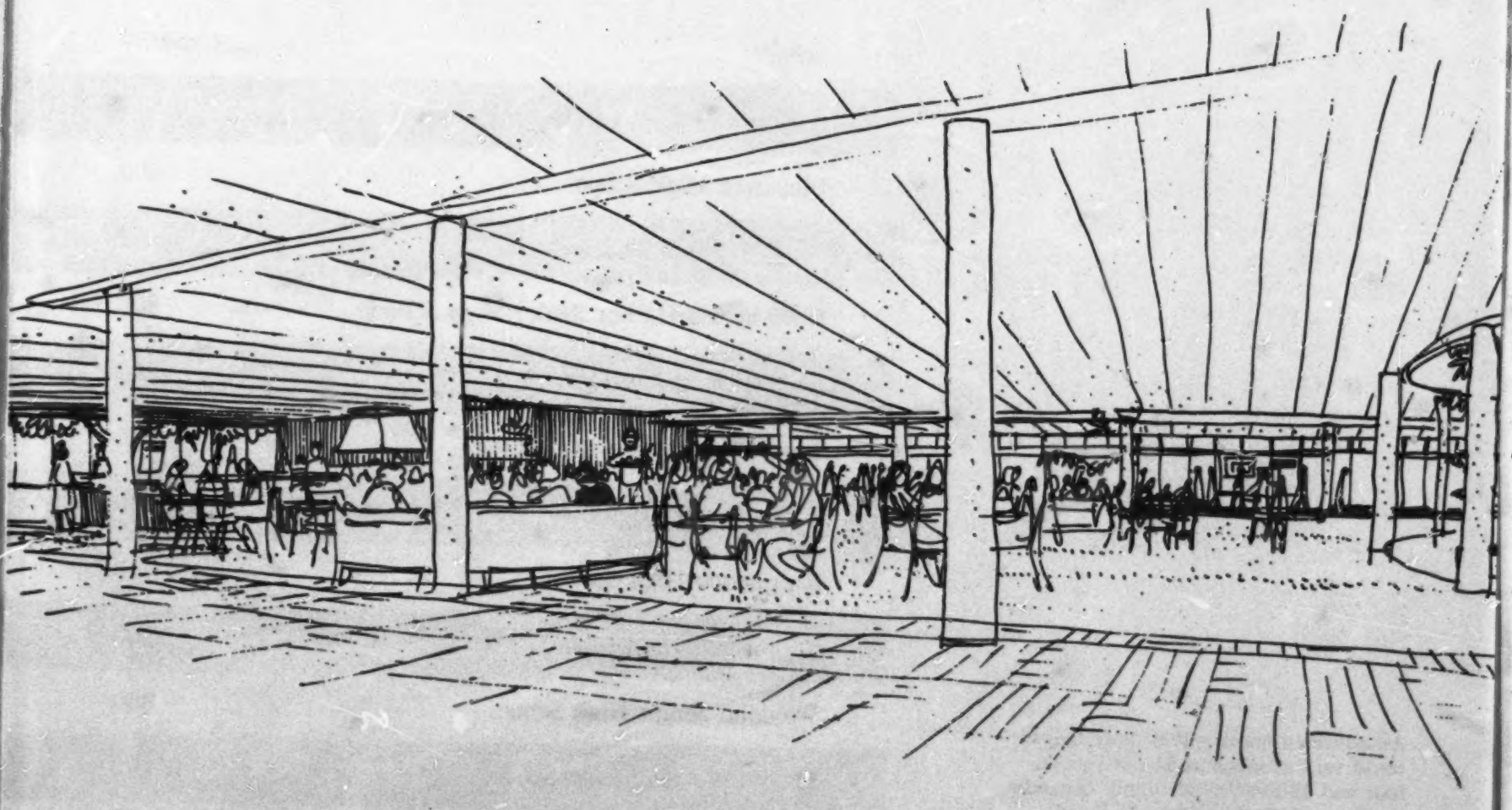


handle 1,180 students. This would give a per pupil cost of $2,265 for this stage.

But — as is often the case with such casual arithmetic — this is a deceptive figure. Much of the space at Andrews — the gyms, lockers, little theater, concourse area, library, kitchen — is designed to handle not just 800 or 1,180, but the school's eventual enrollment of 1,500. All that will be needed to bring the school up to that capactiy is a little more academic space — and this is the least expensive part of building at Andrews.

Reid figures that 31,350 square feet of academic space will be needed, bringing the total square footage to 225,943. At today's construction prices this would add $386,545 to the $2,672,100 that Andrews cost, excluding site and movable equipment but including all mechanical costs and the carpeting. The cost per square foot on this basis would be $13.54 and the per pupil cost $2,039.

These cost figures indicate that a community can get both flexibility and amenity within conventional costs. If Andrews can obtain a high quality schoolhouse with air conditioning and carpeting for this price, it is likely that the environment of all our high schools can be vastly, and still economically, improved.



The concourse commons area is designed to act as both a lounge and a cafeteria.

8. THE ASSAULT ON COST

The cost of any schoolhouse is elusive.

Even assuming that some indisputable yardstick was available, which it is not, there are countless intangible benefits and losses hidden in every building, benefits and losses that cannot be reduced to dollars and cents. How much money is it worth for a child to feel his school beckons him to come in and stick around for a while? How much actual cash is wasted if a school building is too hot for occupancy every summer?

Admitting all of the imponderables and the difficulty of arriving at a truly meaningful cost per square foot or cost per pupil figure, it *is* possible to make rough, very rough, comparisons between schools. It is also possible, in a general way, to make judgments as to whether or not one school is remarkably economical or outlandishly expensive.

The over-all average cost of the schools discussed in this report is $13.95 per square foot.[12] The average cost per pupil is $1,629.

These figures justify one conclusion: None of these is an exorbitantly expensive schoolhouse for its region. And some of these schools are remarkable examples of prudent economy. McPherson, for instance, is an inexpensive school by almost any standard one might wish to

[12] *According to an* EFL *survey made in 1959, the median cost of 72 high schools scattered throughout the country was $15.99. See* The Cost of a Schoolhouse—*available from* EFL *on request.*

School	*Capacity*
Andrews Senior High School	1,180
Blackwell High School	600
W. E. Boswell High School	509
Cold Spring Harbor Senior High School	800
C. E. Donart High School	800
Lamphere Senior High School	800
South Park High School	1,200
Ridgewood High School	1,040
McPherson High School	1,100
Wayland Senior High School	850
Plainview Junior High School	2,200

*Includes $159,999 for equipment and $40,153 for kitchen equipment.

An educated guess is that these figures could vary as much as $1 per square foot and $200-$300 per pupil, depending on the method of computation used.

chose. Andrews, too, is economical in relation to educational productivity per dollar.

But, most important, all these communities permitted their architects and educators to create an educational environment of great promise.

This, then, is the fundamental reason for the assault on cost and the quest for economy: not just saving money for the sake of thrift, but a search for better ways to design the high school enclosure so that it makes a more direct, more powerful contribution to the education of young people.

The entire discussion can be summed up this way:

Architectural technology is always on the move, in the direction of providing man with a higher quality of space and a more amenable environment in which to live and work. Educational technology—new methods of teaching, new devices for learning — is on the move, too, in the direction of providing ways for more children to learn more. It is the community that explores these new, and hopefully better, ways of designing, constructing, using, and equipping school space that will, in the longest of runs, turn out to have the most usefu' and economical schoolhouse.

Area/sq. ft.	*Cost/building alone*	*Cost/sq. ft.*	*Cost/pupil*	*Air conditioning*
194,593	$2,672,100	$13.73	$2,265	yes
53,177	$ 717,454	$13.49	$1,196	part now/rest future
54,661	$ 730,797	$13.37	$1,436	partial
108,424	$1,893,916	$17.47	$2,367	future
60,636	$ 788,946	$13.01	$ 986	future
117,043	$1,505,000	$12.86	$1,881	no
99,906	$1,198,100	$11.99	$ 998	yes
140,117	$1,856,558	$13.25	$1,785	no
112,472	$1,326,980*	$11.80	$1,206	yes
110,376	$1,580,412	$14.32	$1,859	no
201,081	$3,720,000	$18.50	$1,691	future

9.
EPILOGUE

No attempt has been made here to draw a plan for a perfect school or to say that these and only these are the directions in which the American high school is heading. From the best available evidence, these are some of the promising directions, and these are some of the schools that embody those directions.

As a quick check list of both the educational and spatial trends, the following changes, or variations upon them, will almost surely be a part of the emerging American high school:

The teachers will work together in teams and the students will be arranged so that the high school can offer a more individualized form of instruction and use the time and talent of teachers more professionally and productively. The teachers will have office spaces in which to work, prepare lessons, and counsel students.

The reorganization of staff and students will result in a reshaping of classes into large and small groups. Space will be adaptable through operable walls and specific design.

Much learning will be accomplished by students working on their own. Libraries or resource centers will contain more books, plus tapes, films, records, programmed learning, and other materials. Independent study space will be scattered throughout the school. Space and schedules will be arranged to help students to obtain materials needed for independent study.

Space will increasingly be clustered to provide broader, more malleable areas and a more natural and intimate relationship between the various parts of a school, and to promote a more efficient and productive use of space, time, staff, and materials.

The high school will operate throughout more of the year, not only for the education of young people, but as a community center for education and recreation for persons of all ages.

There will be an increasing use of automated, machine assistance both for administrative work, clerical chores, and machine scheduling, and for instruction: programmed learning machines, television, automated testing, audio-visual devices.

The high school will concern itself with the relation of quality of environment to effectiveness of learning. The emerging high school building will be designed more for performance than for permanence, more for instructional efficiency than for janitorial ease.

That old devil cost will always be a major source of debate in the design of high schools, but ideas about cost will change. More of the total cost will be going into equipment, less into the shell. It may well be that with the adoption of new teaching methods, and the exploration of new and better methods of designing and constructing schools, the new American high school will educate more children better and for less money than a brute expansion of the conventional high school ever could.

10. THE SCHOOLS

Andrews Senior High School: 68-77

Blackwell High School: 50-51

W. E. Boswell High School: 52-54

Cold Spring Harbor Senior High School: 28-31, 41

C. E. Donart High School: 42, 53-54

Lamphere Senior High School: 25-25, 31-32, 40

McPherson High School: 56-59, 65-67

Plainview Junior High School: 62-63

Ridgewood High School: 14-15, 17, 19, 20-23, 26-27, 36-37, 43-44

South Park High School: 64-65

Wayland Senior High School: 14-23, 27-28, 61

ANDREWS SENIOR HIGH SCHOOL—

Location: Andrews Independent School District, Andrews, Texas
To open: January, 1962
Grades: 9 — 12
Enrollment when it opens: 800 students
Capacity: 1,180 students
Superintendent: T. A. Roach
Architects: Reid, Rockwell, Banwell, and Tarics, San Francisco, California
Design: Robert F. Olwell, John E. Coyle
Acoustics: Dariel Fitzroy

The Andrews Independent School District in west Texas is a county-wide system comprising 1,503 square miles. The total 1960 county population was 13,450 which included 3,662 children of school age.

The school population has more than doubled during the past six years, and since January of 1955 the school district has contracted for approximately $6.5 million in buildings, sites, and equipment.

BLACKWELL HIGH SCHOOL—

Location: Independent School District No. 45, Blackwell, Oklahoma
To open: September, 1962
Grades: 10 — 12
Capacity: 600 students
Superintendent: Leonard L. White
Architects: Caudill, Rowlett & Scott, Texas, Oklahoma, Connecticut
Project Architect: Wendell V. Locke
Project Designer: Frank D. Lawyer
Educational Consultants: The University of Oklahoma and Oklahoma State University at Stillwater

Blackwell, Oklahoma, a city of about 10,000 people, is located in northern Oklahoma in a mainly agricultural area. School enrollments total approximately 2,400 and have remained relatively constant. An extensive building program since 1950 has assured that all students go to fairly new schools.

No expansion of academic facilities is planned for Blackwell High School. However, since the present budget was not enough to build the entire plan, the vocational shops, auditorium-music facilities, and gymnasium will be added later.

Air conditioning will be provided in the future for the entire school; at this stage only the individual study centers and teacher reference facilities will be air-conditioned.

W. E. BOSWELL HIGH SCHOOL—

Location: Eagle Mountain/Saginaw Independent School District, Saginaw, Texas
To open: September, 1961
Grades: 9 — 12
Enrollment when it opens: 300 students
Capacity: 509 students
Superintendent: George S. Stott
Architects: Caudill, Rowlett & Scott, Texas, Oklahoma, Connecticut
Project Architect: Virgil P. Dean
Project Designer: Frank D. Lawyer

The Eagle Mountain/Saginaw Independent School District covers a 60-square mile suburban area on the northern outskirts of Ft. Worth, Texas. It includes two towns, Saginaw and Blue Mountain, and two as yet unincorporated areas. The total population of the district is now about 4,000 with 1,050 school age children.

The District has a rapidly increasing school population which is expected to triple by 1970. Therefore, Boswell High School was planned for expansion.

In its first stage, the school will be comparatively small, composed of four units: shop, gym, activities building, and academics building. More academic units will be added later, and organization will be by "little schools." The architects predict that only additional academic units will be needed until enrollment reaches 750.

COLD SPRING HARBOR SENIOR HIGH SCHOOL—

Location: Central School District No. 2, Huntington/Oyster Bay, *Long Island, New York*
To open: October, 1961
Grades: 9 — 12
Enrollment when it opens: 300 students
Capacity: 800 students
Superintendent: Shaun Kelly
Principal: Francis Roberts
Architects: Sherwood, Mills and Smith, Stamford, Connecticut
Design: Willis Mills

Educational Consultants: Kargman, Mitchell, and Sargent, Cambridge Consultants, Inc.

Central School District No. 2 includes the three small villages of Lloyd Harbor, Laurel Hollow, and Cold Spring Harbor, all of which are part of the Townships of Huntington and Oyster Bay. The District itself is largely a residential area, located on the North Shore of Long Island about 35 miles from New York City. Among the residents are a high percentage of professional men and business management personnel.

Total school district enrollment is 1,200. The long-range educational plan calls for the development of an ungraded kindergarten through high school program, which will include primary schools, middle schools, and the Cold Spring Harbor High School.

C. E. DONART HIGH SCHOOL –

Location: Stillwater, Oklahoma
Opened: September, 1960
Grades: 10 — 12
Enrollment: 800 students
Superintendent: William D. Carr
Principal: Carl Tilley
Architects: Caudill, Rowlett & Scott, Texas, Oklahoma, Connecticut
Associate Architect: Philip A. Wilber
Project Architect, Designer: C. Herbert Paseur

Stillwater, Oklahoma is a city of 23,748 situated halfway between Tulsa and Oklahoma City. The economic community is a balanced mixture of oil wells, light manufacturing, and the growing of small grains for livestock and agricultural purposes. The city also is the home of Oklahoma State University.

The schools of Stillwater house 3,800 children and are growing at a rate of about 5 per cent a year. The C. E. Donart High School will this year begin pilot projects in team teaching and programmed instruction in mathematics.

LAMPHERE SENIOR HIGH SCHOOL –

Location: Lamphere Public School District, Madison Heights, Mich.
To open: October, 1961
Capacity: 900 students
Superintendents: Herbert E. Humbert (1959-61), Frederick D. Thorin, present superintendent
Principal: Edward P. Harkins
Architects: H. E. Beyster and Associates, Detroit, Michigan
Project Coordinator: C. H. Haberkorn
Designer-in-charge: John Jensen

The Lamphere Public School District is located in Madison Heights, Michigan, a suburb four miles north of Detroit. Incorporated five years ago, its population is now 33,000, mostly middle-income employees in Detroit. The District includes three-fifths of Madison Heights and a small portion of the neighboring suburb of Troy.

McPHERSON HIGH SCHOOL –

Location: District No. 20, McPherson, Kansas
To open: September, 1962
Grades: 10 — 12
Enrollment when it opens: 800 students
Capacity: 1,100 students
Superintendent: Joe W. Ostenberg
Assistant Superintendents: R. R. Uhrlaub, T. R. Washburn
Architects: Shaver & Company, Salina, Kansas/Beatrice, Nebraska
Design: John A. Shaver
Educational Consultants: Stanford University School Planning Laboratory:
James D. MacConnell, William R. Odell, Don L. Davis

McPherson, a city of approximately 10,000 people, is located in an agricultural and oil-producing area near the center of Kansas. The city itself has two colleges, and more than 60 per cent of the McPherson High School graduates go on to college. McPherson has four grade schools, a middle school, and a senior high school, with a total public school enrollment of nearly 2,400 pupils.

Type	*State*	*Cost*	*Area/sq ft*	*Cost/sq ft*
Senior High	Kansas	$1,255,555	70,000	$17.94
Junior High	Kansas	$1,348,998	84,950	$15.88
Senior High	Kansas	$3,628,400	232,790	$15.88
High School	Kansas	$3,569,845	226,200	$15.78
Senior High	Kansas	$1,516,216	97,413	$15.56
Junior High	Kansas	$1,064,803	71,362	$14.92
Intermediate	Kansas	$1,444,326	100,718	$14.34
Junior High	Kansas	$1,273,846	89,000	$14.31
Intermediate	Kansas	$1,501,365	105,360	$14.25
Junior High	Kansas	$ 744,603	52,671	$14.14
Intermediate	Kansas	$1,339,055	94,784	$14.13
Senior High	Kansas	$1,825,120	132,736	$13.75
Senior High	Kansas	$1,540,000	114,000	$13.51
High School	Kansas	$ 942,769	71,362	$13.21
Junior High	Oklahoma	$1,158,300	90,000	$12.87
Senior High	Kansas	$1,546,865	121,000	$12.78
Junior High	Nebraska	$1,339,540	107,421	$12.47
High School	Kansas	$ 970,340	80,000	$12.13
High School	Kansas	$1,635,091	135,510	$12.07
Junior High	Oklahoma	$ 840,000	70,000	$12.00
Junior High	Nebraska	$1,264,740	105,836	$11.95
Junior High	Kansas	$ 940,245	82,200	$11.43
Mean cost/sq. ft. for 22 schools				$13.88
McPherson Senior High School		$1,326,986	112,472	$11.80

PLAINVIEW JUNIOR HIGH SCHOOL—

Location: Plainview/Old Bethpage, Long Island, New York
To open: September, 1963
Grades: 6 — 9
Capacity: 2,200 students
Superintendent: Robert F. Savitt
Architects: Perkins and Will, Chicago, Illinois/White Plains, New York
Project Architects: Richard Heinrichs
Design: Manfred Herfschmid

Plainview/Old Bethpage, New York, located 25 miles east of New York City on Long Island, is composed primarily of commuters to New York City. The school district is one of the fastest growing in the United States: in 1952 it had a student poulation of 100; today it has a population of over 10,000 students. Twelve new school buildings have been approved in the last eight years, and the voters have provided over $25,000,000 for new school construction to house these students.

RIDGEWOOD HIGH SCHOOL—

Location: Cook County High School District No. 243, Norridge, Illinois
Opened: September, 1960
Grades: 9 — 10 for 1960-61, 9 — 12 ultimately
Capacity: 1,040 students
Superintendent: Eugene R. Howard
Assistant Superintendent (in charge of instruction): Melvin P. Heller
Architects: Orput and Orput, Rockford, Illinois
Educational Consultant: J. Lloyd Trump, Associate Director, National Association of Secondary School Principals

Cook County High School District 243, just northwest of Chicago, includes the town of Norridge and part of the town of Harwood Heights. The district has a population of approximately 20,000 and an area of 3½ square miles. The community is composed predominantly of middle-class, single-family residences. An active zoning board has planned and encouraged extensive commercial and light industrial development.

In addition to housing an unusual program, Ridgewood High School has answered a difficult design challenge.

The architects had to solve the problems of building on a site that was limited (mostly reclaimed swamp land); they had the usual cost limitations, with the added necessity of proceeding very rapidly in cold weather to permit the maintaining of a tight construction schedule. (This was highly important since $150,000 was saved in tuition fees to an adjoining school district by completing the school by September, 1960.)

Modular construction was used throughout to permit rapid assembly at the job site. Precast concrete columns also permitted construction to take place in very cold weather.

SOUTH PARK HIGH SCHOOL—

Location: South Park Independent School District, Beaumont, Texas
Opened: September, 1960
Grades: 9 — 12
Capacity: 1,200 students
Superintendent: Joseph J. Vincent
Architects: Golemon & Rolfe, Houston and Beaumont, Texas

In the oil refineries and shipyards of Beaumont, the school population is about 10,500 children drawn from 127 square miles of urban and suburban territory outside of Beaumont, Texas. Because of the boom in the oil refineries and shipyards of Beaumont, the school poulation jumped from 2,000 before World War II to the present figure. Between 1947 and 1959, the District built $11,500,000 worth of new schools. South Park High School is the District's newest school.

WAYLAND SENIOR HIGH SCHOOL—

Location: Wayland, Massachusetts
Opened: September, 1960
Grades: 10 — 12
Enrollment: 664 students
Capacity: 850 students
Superintendent: Edward J. Anderson
Principal: W. Maxwell Griffin
Architects: The Architects Collaborative. Cambridge, Massachusetts
In charge of design: John C. Harkness, Herbert K. Gallagher
Educational Consultants: Kargman, Mitchell, and Sargent
Cambridge Consultants, Inc.

Wayland, Massachusetts, lies 16 miles west of Boston. Population in 1950 was 4,400; today, 10,000. Many Wayland residents work in the town's shops and service industries or still commute to Boston. But an increasing number are professional people — scientists, college teachers, engineers, and executives — who have settled their families in the carefully zoned forests of Wayland and work in the industrial parks alongside Route 128 where New England's missile and electronics plants are booming. Wayland is also close to Harvard and M.I.T.

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HIGH SCHOOLS 1962

Prepared by Evans Clinchy, *Editorial Associate*

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